

Reel tines

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## Description

The invention relates to a reel tine for the attachment on a carrier tube of a reel, which is crosswise drilled through and, respectively, has in the area of two attachment bores arranged on one bore axis and extending through the wall of the carrier tube sink portions directed to the inside. The reel tine is retainable by a screw on the carrier tube.

The reel of a harvesting machine comprises generally several carrier tubes, distanced radially to a central tube and circumferentially distributed around this and which are supported by corresponding bearing arms, connected to the central tube. The carrier tubes themselves are pivotably supported on the bearing arms. As the width of the cutting table of a harvesting machine is especially large in modern machines, the reels are also formed correspondingly long and also the corresponding carrier tubes. The carrier tubes carry reel tines, which are arranged distributedly along its length. For example, on a six meter long carrier tube, 40 or more tines are generally attached. In a reel with six carrier tubes, therefore, 240 tines are provided.

Preferably, two basic types of reel tines are used. Reel tines made from steel are preferred for harvesting goods, which are difficult to collect and to be transported into the cutting table of the cutting section. For example, these are used for cereals and especially for cereals lying on the ground or in the grass harvesting.

For other harvesting goods, for example beans and other leguminous fruit, reel tines made from plastic materials are preferably used. The above named harvesting goods have to be cut close to the ground, as the first shoots already grow close to the ground on stalks. In the modern very wide cutting tables of harvesting devices, for example combine harvesters, for these harvesting goods very flexible cutter bars are used, which are guided in the operating position in contact with the ground in front of the cutting table and which cut the harvesting good. On an uneven ground these flexible cutter bars carry out at least partially a vertical movement relative to the cut-

ting table. In this case, when lifting the cutter bar, it happens, that one or a multitude of reel tines get between the reciprocating blades of the cutter bar. With reel tines made from plastic material a shearing-off of the tip of the same happens, however, no negative influence onto the blade nor the cutter bar drive follows.

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Generally in carrier tube cross-wise extending attachment bores are punched in, wherein the deformations in the form of the sink portions are produced. When the bores are produced from diametrical sides, the carrier tube is provided with two opposite directed, funnel-like sink portions. Different reel tines made from plastic materials are known, which can be attached to such carrier tubes.

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US 48 82 899 discloses a reel tine manufactured from plastic material, which has a clip-like portion, enclosing the carrier tube and wherein the two opposed attachment portions are clamped against each other by a screw. Furthermore, on the bore portion enclosed by the clip portion a projection is formed, which engages in the recess or a sink portion of the carrier tube. Furthermore on the reel tines lateral wing-like profiled strips are formed, of which one has at its free end face a recess and the other one a projection. During a stronger radial loading the enclosing strip is deformed, the pin-like lug leaves the bore and a rotational displacement is produced relative to the carrier tube, so that the reel tine cannot fulfil its function. The wing-like formed on profiled strips extend over half the distance to a neighbouring reel tine and engage there with the opposite directed profiled strip of the neighbouring tine by means of the tongue and groove connection. This connection is, however, instable, so that then, when a reel tine is displaced on the carrier tube due to overloading, also the tongue and groove connection is detached. Furthermore, in this construction the distances of the reel tines on the carrier tube have to correspond correctly to each other. A later adaptation is not possible, when replacing these.

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US 61 99 358 relates to a reel tine made from plastic material, which has an attachment portion with a recess, which forms an abutment face to a portion on the outer face of the carrier tube. The carrier tube has the two attachment bores, arranged on one bore axis, which different to the common design are not part of sink portions. In the area of the recess of the attachment portion of the reel tine a pin projection is

provided, in which a bore is provided. The reel tine projects with this pin projection through the attachment bore into the inside of the carrier tube. Starting from the opposite attachment bore a screw with a countersunk head is screwed in and retains by this the reel tine on the carrier tube. The raking-in portion is formed rod-like and bent and has a front contact face. It is formed tapered widthwise from an approximately centre portion in direction to its free end. Of disadvantage is, that the projection made from plastic material has to absorb the full loading in connection with the screw. When being loaded a strong tensile force acts onto the screw, so that a detaching often results.

Finally, US 63 24 823 B1 describes a reel tine made from plastic material, which can be attached on a carrier tube provided with diametrical sink portions. It has an attachment portion, which is elongated, wherein on the elongations cone-like formed-on thickenings are provided, filling the sink portions of the carrier tube. A screw is passed through this thickenings and the carrier tube and a clamping of the same is achieved by a nut screwed onto the head screw. The thickenings engage also in the diametrical attachment bores. Of disadvantage is especially, that the use of a head screw with a nut leads to the fact, that the diameter is enlarged and, thus, the projecting portion leads to the fact, that easily winding harvesting goods can be entangled thereon.

Object of the invention is, to provide a reel tine, which raking-in portion and attachment portions are integrally formed from plastic material and which can be securely positioned and attached on the carrier tube, so that also during strong loading no displacement can be produced on the carrier tube or that the screw connection even detaches. Furthermore, it should be ensured, that the harvesting good does not get entangled. The reel tine also should, without necessitating a form change on the attachment portion and raking-in portion, be useable on tubes having different sink portions or also on tubes, which have no sink portions.

This object is solved according to the invention by a reel tine for attachment on a carrier tube of a reel, which is drilled through cross-wise forming two attachment bores and especially having, respectively, in the area of the two attachment bores arranged

on one bore axis and extending through the wall of a carrier tube, two sink portions directed inwards, by means of a screw, comprising

-a raking-in portion,

-formed rod-like and

-having a front contact face,

-an attachment portion,

- which is formed integrally with the raking-in portion from plastic material,

- having a recess with an abutment face for the abutment on the carrier tube and

- from which abutment face a first bore portion starts, from which again a second bore portion for receiving the threaded shaft of the screw starts, and

-a connection sleeve,

- having a first sleeve portion, which is accommodated in the first bore portion,

- having a second sleeve portion, insertable into an attachment bore.

Of advantage in this design is, that via the connection sleeve an adaptation to differently formed carrier tubes can be achieved, without having to change the connection portion formed integrally with the raking-in portion. Thus, the connection sleeve can be adapted to the different bore forms of the attachment bores in the carrier tube. Furthermore, it is advantageous, that this connection sleeve can be made from a hard wearing material which is also less sensitive to shear stress. By means of the depth of the first bore portion in the attachment portion, a sufficiently advantageous connection to the connection sleeve can be achieved. Furthermore, the abutment face of the recess of the attachment portion can also be formed such, that an adaptation or attachment, respectively, to carrier tubes having different diameters are possible.

In case that carrier tubes with sink portions are used, it is sensible, that the connection sleeve has a collar separating the first sleeve portion from the second sleeve portion and projects radially therefrom. This collar can be, for example, used to fill-out the sink portion. Thus, it is obvious, that for reel tines according to the invention in an

identical design of the integrally formed raking-in portion made from plastic material with the connection portion, an adaptation to the different carrier tube shapes can be achieved such, that only a connection sleeve adapted to the respective carrier tube is used. The tools, necessary especially for the manufacture of the plastic material component, can, therefore, only be designed for one single type, whereby the tool costs are significantly reduced.

To be able to achieve the necessary form rigidity in the area of the raking-in portion, it is further provided, that the raking-in portion has on its face facing away from the front contact face at least one reinforcement rib, which starts from the attachment portion and ends in front of a free end of the raking-in portion. An especially advantageous design is achieved, when two ribs are provided, which approach each other, starting from the attachment portion in direction towards the free end, and, for example, merge. Thus, the ribs have in the area of the attachment portion the largest distance. Preferably, it is provided, that the height of the ribs in direction to the free end of the raking-in portion decreases. Also the width of the contact face of the raking-in portion can decrease towards the free end.

An advantageous embodiment provides, that the integral area consisting of the connection portion and the raking-in portion is made from an elastic plastic material. Preferably it is provided, that the reel tine is made from a polyamide material (PA), a polyoxymethylene material (POM) or a polypropylene material (PP). Preferably, the connection sleeve is made from metal, especially steel, or a tough plastic material. In case, that additional profiled strips should be used, it is provided, that the attachment portion has at its two side faces grooves for the accommodation of the ends of a profiled strip. In case, that namely the pitch of the attachment bore on the carrier tube is not exactly maintained, it is possible, to adapt the profiled strip still during the exchange or in the working environment by means of cutting it into lengths from a larger profiled strip to the given conditions.

This is also possible, when a profiled strip is formed on the attachment portion at one side laterally projecting and the attachment portion has on the side face facing away from the same, a groove for the accommodation of the profiled strip of a neighbouring

reel tine. When, hereby, always a sufficient large profiled strip length is provided, an adaptation is still possible during an exchange in the working environment.

The invention is described in more detail by means of the embodiments shown schematically in the drawing.

It shows

Fig. 1 a first embodiment of a reel tine according to the invention in a exploded side view, together with the cross-wise cut carrier tube and the screw for the attachment,

Fig. 2 the reel tine of Fig. 1 mounted on the carrier tube with its attachment portion in a cross-sectional view,

Fig. 3 a rear view onto the reel tine of Fig. 2 in the direction of the arrow A of Fig. 2,

Fig. 4 a rear view of a different embodiment of a reel tine with an integrally formed-on profiled strip and with the inserted connection sleeve,

Fig. 5 a side view of the reel tine of Fig. 4 in the direction of the arrow B of Fig. 4 with a formed-in groove for the profiled strip,

Fig. 6 two reel tines attached distanced to each other on a carrier tube with the connection strip,

Fig. 7 a cross-sectional view VII-VII of Fig. 6,

Fig. 8 a further embodiment of a reel tine with two reinforcement ribs in a rear view and

Fig. 9 a cross-sectional view IX-IX of Fig. 8.

In Fig. 1 a first embodiment of a reel tine 1 is shown in an exploded view in reference to the attachment on a carrier tube 2 of a reel. For the attachment, the carrier tube 2 has a first attachment bore 3 and a second attachment bore 4 arranged on the same bore axis 5. These are arranged diametrically opposed and are part of a first sink portion 6 or a second sink portion 7, respectively. These sink portions 6, 7 are off-set relative to the outer face 8 of the carrier tube 2 inside towards the rotational axis 9 of the carrier tube 2. The reel tine 1 comprises a raking-in portion 10 with the contact face 11 arranged in front in rotational direction of the carrier tube 2 and the attachment portion 12 formed integrally therewith. The reel tine 1 has a free end 14 remote from the attachment portion 12 and diametrically to the free end 14 in the attachment portion 12 a recess with the abutment face 13 for abutment on the outer face 8 of the carrier tube 2. From the contact face 11, in direction towards the raking-in portion 10 starts a first bore portion 16, which is larger in diameter, from which again a second bore portion 17 starts. Furthermore, in Fig. 1 a connection sleeve 18 is visible, having a through bore 19. The connection sleeve 18 has a first sleeve portion 20, formed fittingly to the first bore portion 16 in the attachment portion 12. It has, further, a second sleeve portion 21, formed fittingly to the first attachment bore 7, i.e. passes therethrough. The connection sleeve 18 has, further, a collar 22, separating the first sleeve portion 20 from the second sleeve portion 21 and projecting radially concerning the axis 23 of the through bore 19 from these. The collar 22 fills at least partially the sink portion 7. In the case, that a carrier tube is provided without a sink portion, the collar can also be omitted.

The screw 24 serves additionally for the retainment of the reel tine 1 on the carrier tube 2, which has a head 25 formed as a countersunk head and a threaded shaft 26, which can be screwed into the second bore portion 17. The connection sleeve 18 is made from an essentially harder material, having also better shearing characteristics, for example from metal, than the tine 1 and absorbs the shearing forces during the transmission of the forces acting on the raking-in portion 10 and passes these on into the carrier tube 2.

Figures 2 and 3 show the reel tine 1 in the arrangement to the carrier tube 2, i.e. in

the mounted condition, wherein the same is retained by means of the screw 24 on the carrier tube 2. Furthermore, the rib 15 for the reinforcement is visible. This starts on the attachment portion 12 and ends in front of the free end 14.

5 Figures 4 to 6 show an embodiment of a reel tine 101, which corresponds essentially to the retainment of the embodiment of Figures 1 to 3 on the carrier tube, so that concerning the description of these parts it is referred to the description of Figures 1 to 3. Components or portions corresponding to those of the embodiment of Figures 1 to 3, are provided with reference numerals, which compared to those of Figures 1 to 3 are increased by the numerical value 100. Following, however, only the differences  
10 are described.

Different to the embodiment of Figures 1 to 3, on the connection portion 112 a profiled strip 27 is formed on, which extends laterally away from the connection portion  
15 112. The side face of the connection portion 112 facing away from the profiled strip 27 has a groove 28, which cross-section is adapted to that of the profiled strip 27. When comparing Figures 5 and 7, the identity of the cross-sections is visible.

In Fig. 6 the arrangement of two reel tines 101 relative to the carrier tube 2 is shown,  
20 wherein it is visible, that the profiled strip 27 connected in the drawing to the left reel tine 101 engages in the groove 28, arranged on the right of the shown reel tine 101, with its free end.

Figures 8 and 9 show a further embodiment of a reel tine according to the invention,  
25 wherein the components serving for the attachment of the reel tine 201 and portions compared to those of the embodiment of Figure 1 are provided with reference numerals, which are increased by the numerical value 200 compared to those. The attachment of the reel tine 201 and especially the design of the attachment portion 212 and of the connection sleeve 218 correspond to the embodiment of Fig. 1, so that for  
30 the description of the same it is referred to the description of Fig. 1.

Figures 8 and 9 serve only for the explanation of a further reinforcement of the reel tine 201 in the area of the raking-in portion 210 by means of two ribs 215, which,



starting from the attachment portion 212, at which they are further away from each other, are guided to a portion, at which they are united. Thus, a higher rigidity is achieved. The cross-sections of these ribs 215 are visible in Fig. 9.

## Reference numerals list

	1, 101, 201	reel tines
	2	carrier tube
5	3	first attachment bore
	4	second attachment bore
	5	bore axis
	6	first sink portion
	7	second sink portion
10	8	outer face
	9	rotational axis
	10, 110, 210	raking-in portion
	11, 111	contact face
	12, 112, 212	attachment portion
15	13, 113	abutment face
	14, 114, 214	free end
	15, 115, 215	rib
	16	first bore portion
	17	second bore portion
20	18, 118, 218	connection sleeve
	19	through bore
	20	first sleeve portion
	21	second sleeve portion
	22	collar
25	23	axis
	24	screw
	25	head
	26	threaded shaft
	27	profiled strip
30	28	groove